

SN 09/583,599

a1
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1,3-bis[3-(dimethylamino)propyl]urea, quaternized; poly[N,N'-bis(2,2,6,6-tetramethyl-4-piperidinyl)-1,6-hexanediamine-co-2,4-dichloro-6-morpholino-1,3,5-triazine; polyacrylamide; poly(acrylamide-co-diallyldimethylammonium chloride); poly(diallyldimethylammonium chloride); poly(melamine-co-formaldehyde), partially methylated; poly(4-vinylpyridine), 25% cross-linked; and poly(1,2-dihydro-2,2,4-trimethylquinoline).

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6. (Amended) The composition as claimed in claim 5 wherein said polysaccharide carrier is selected from the group consisting of starch, cellulose, amylopectin and amylose.

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11. (Amended) The composition as claimed in claim 1 wherein said organic compound is selected from the group consisting of poly[(bis(2-chloroethyl)ether-alt-1,2-bis[3-(dimethylamino)propyl]urea, quaternized, and poly(diallyl dimethylammonium chloride).

a4

13. (Amended) An acid copper electroplating composition comprising an aqueous solution of an acid and a copper salt, the improvement comprising the addition of at least one of a carrier compound; a water-soluble, mercapto-containing organic brightener compound; and a leveler compound selected from the group consisting of 2,5-dithiobiurea, dithiooxamide, 1-phenyl-2-thiourea, diethylenetriamine, *p*-xylenebis(tetrahydrothiophenium) chloride, pseudo thiohydantoin, (R)-(-)-thiazolidine-4-carboxylic acid, 3-(2'-thiopyridinium) propyl sulfonate, 2,2'-dipyridyl disulfide, 4,4'-dipyridyl disulfide, thionicotinamide, 4-(trifluoromethyl)-2-pyrimidinethiol, 2-mercapto-4-methylpyrimidine hydrochloride, 5-phenyl-1 *H*-1,2,4-triazole-3-thiol, 5-(4'-pyridyl)-1 *H*-1,2,4-triazole-3-thiol, 2-amino-6-purinethiol, 4-amino-5-(4'-pyridyl)-4 *H*-1,2,4-triazole-3-thiol, diethyl heptadecyl imidazolinium ethylsulfate, hexamethylenetetraamine, 1,3-bis(3-pyridylmethyl)-2-thiourea, 2,4-diamino-6-mercaptopyrimidine hemisulfate, dithiouracil, 4,5-diamino-2,6-dimercaptopyrimidine, 4,5-diamino-6-hydroxy-2-mercaptopyrimidine hemisulfate hydrate, 4(5)-imidazoledithio-carboxylic acid, 2-mercapto-5-benzimidazole-sulfonic acid, sodium salt dihydrate, 2-thiouracil, trithio cyanuric acid, (2-pyrimidylthio) acetic acid, 7-trifluoromethyl-4-quinlinethiol, 5-carbethoxy-2-thiouracil, 1 *H*-1,2,4-triazole-3-thiol, 1-phenyl-1 *H*-1,2,4-triazole-5-thiol, *N,N'*-ethylene thiourea, and 2-mercapto benzothiazole.

14. (Amended) The composition as claimed in claim 13 wherein said leveler compound is selected from the group consisting of diethylenetriamine and thionicotinamide.

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21. (Amended) An improved method for making an acid copper electroplating bath comprising an aqueous solution of acid and copper salt, the improvement comprising adding to said bath a

SN 09/583,599

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carrier compound; a water-soluble, mercapto-containing organic brightener compound; and a leveler compound which comprises an organic compound containing single or multiply positively charged centers; wherein said organic compound is selected from the group consisting of polyethylenimine, 80% ethoxylated; poly (allylamine); poly (allylamine hydrochloride); polyaniline, sulfonated, 5 wt. % in water, 75 mole % sulfonated; poly[bis (2-chloroethyl)ether-alt-1,3-bis[3-(dimethylamino)propyl]urea, quaternized; poly[N,N'-bis(2,2,6,6-tetramethyl-4-piperidiny)]-1,6-hexanediamine-co-2,4-dichloro-6-morpholino-1,3,5-triazine; polyacrylamide; poly(acrylamide-co-diallyldimethylammonium chloride); poly(diallyldimethylammonium chloride); poly(melamine-co-formaldehyde), partially methylated; poly(4-vinylpyridine), 25% cross-linked; and poly(1,2-dihydro-2,2,4-trimethylquinoline).

23. (Amended) The method as claimed in claim 22 wherein said polysaccharide carrier is selected from the group consisting of starch, cellulose, amylopectin and amylose.

28. (Amended) The method as claimed in claim 21 wherein said organic compound is selected from the group consisting of poly[(bis (2-chloroethyl)ether-alt-1,3-bis [3-(dimethylamino)propyl]urea, quaternized, and poly (diallyldimethylammonium chloride).

30. (Amended) An improved method for making an acid copper electroplating bath comprising an aqueous solution of acid and copper salt, the improvement comprising adding to said bath a carrier compound; a water-soluble, mercapto-containing organic brightener compound; and a leveler compound selected from the group consisting of 2,5-dithiobiurea, dithiooxamide, 1-phenyl-2-thiourea, and diethylenetriamine, p-xylenebis(tetrahydrothiophenium) chloride, pseudo thiohydantoin, (R)-(-)-thiazolidine-4-carboxylic acid, 3-(2'-thiopyridinium) propyl sulfonate, 2,2'-dipyridyl disulfide, 4,4'-dipyridyl disulfide, thionicotinamide, 4-(trifluoromethyl) -2-pyrimidinethiol, 2-mercapto-4-methylpyrimidine hydrochloride, 5-phenyl-1 H-1,2,4-triazole-3-thiol, 5-(4'-pyridyl)-1 H-1,2,4-triazole-3-thiol, 2-amino-6 purinethiol, 4-amino-5-(4'-pyridyl)-4 H-1,2,4-triazole-3-thiol, diethylheptadecyl imidazolium ethylsulfate, hexamethylenetetraamine, 1,3-bis(3-pyridylmethyl)-2-thiourea, 2,4-diamino-6 mercaptopyrimidine hemisulfate, dithiouracil, 4,5-diamino-2,6-dimercaptopyrimidine, 4,5-diamino-6-hydroxy-2-mercaptopyrimidine hemisulfate hydrate, 4(5)-imidazoledithio-carboxylic acid, 2-mercapto-5-benzimidazolesulfonic acid, sodium salt dihydrate, 2-thiouracil, trithio cyanuric acid, (2-pyrimidylthio) acetic acid, 7-trifluoromethyl-4-quinlinethiol, 5-carbethoxy-2-thiouracil, 1 H-1,2,4-triazole-3-thiol, 1-phenyl-1 H-1,2,4-triazole-5-thiol, N,N'-ethylene thiourea, and 2-mercapto benzothiazole.

SN 09/583,599

31. (Amended) The method as claimed in claim 30 wherein said organic compound is selected from the group consisting of diethylenetriamine and thionicotinamide.

39. (Amended) A method for copper plating of advanced interconnects comprising immersing said interconnects in a copper plating bath comprising an aqueous solution of an acid and a copper salt and at least one of a carrier compound; a water-soluble, mercapto-containing organic brightener compound; and a leveler compound containing single or multiply positively charged centers; wherein said leveler compound is selected from the group consisting of polyethylenimine, 80% ethoxylated; poly(allylamine); poly(allylamine hydrochloride); polyaniline, sulfonated, 5 wt. % in water, 75 mole % sulfonated; poly[bis(2-chloroethyl)ether-alt-1,3-bis[3-(dimethylamino)propyl]urea, quaternized; poly[N,N'-bis(2,2,6,6-tetramethyl-4-piperidyl)-1,6-hexanediamine-co-2,4-dichloro-6-morpholino-1,3,5-triazine; polyacrylamide; poly(acrylamide-co-diallyldimethylammonium chloride); poly(diallyldimethylammonium chloride); poly(melamine-co-formaldehyde), partially methylated; poly(4-vinylpyridine), 25% cross-linked; and poly(1,2-dihydro-2,2,4-trimethylquinoline).

49. (Amended) The method as claimed in claim 47 wherein said leveler compound is selected from the group consisting of poly[(bis(2-chloroethyl)ether-alt-1,2-bis[3-(dimethylamino)propyl]urea, quaternized, and poly(diallyl dimethylammonium chloride).

51. (Amended) A method for copper plating of advanced interconnects comprising immersing said interconnects in a copper plating bath comprising an aqueous solution of an acid and a copper salt and at least one of a carrier compound; a water-soluble, mercapto-containing organic brightener compound; and a leveler compound selected from the group consisting of 2,5-dithiobiurea, dithiooxamide, 1-phenyl-2-thiourea, diethylenetriamine, p-xylenebis(tetrahydrothiophenium) chloride, pseudo thiohydantoin, (R)-(-)-thiazolidine-4-carboxylic acid, 3-(2'-thiopyridinium) propyl sulfonate, 2,2'-dipyridyl disulfide, 4,4'-dipyridyl disulfide, thionicotinamide, 4-(trifluoromethyl)-2-pyrimidinethiol, 2-mercapto-4-methylpyrimidine hydrochloride, 5-phenyl-1 H-1,2,4-triazole-3-thiol, 5-(4'-pyridyl)-1 H-1,2,4-triazole-3-thiol, 2-amino-6-purinethiol, 4-amino-5-(4'-pyridyl)-4 H-1,2,4-triazole-3-thiol, diethyl heptadecyl imidazolinium ethylsulfate, hexamethylenetetraamine, 1,3-bis(3-pyridylmethyl)-2-thiourea, 2,4-diamino-6-mercaptopyrimidine hemisulfate, dithiouracil, 4,5-diamino-2,6-dimercaptopyrimidine, 4,5-diamino-6-hydroxy-2-mercaptopyrimidine hemisulfate hydrate, 4(5)-imidazoledithio-carboxylic acid, 2-mercapto-5-benzimidazolesulfonic acid, sodium salt dihydrate, 2-thiouracil, trithio cyanuric acid, (2-pyrimidylthio) acetic acid, 7-trifluoromethyl-4-